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OTOLOGY

Surgical and nonsurgical treatment outcomes in traumatic facial nerve palsy

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Abstract

Purpose Facial nerve decompression surgery is performed on patients with immediate, complete traumatic facial palsy. However, the clinical advantage of the surgical treatment has weak evidence because of lack of control groups in previous studies. Therefore, this study compared facial function outcomes between the patients who underwent surgery and those who did not. Furthermore, in cases of bilateral traumatic facial palsy, the outcomes of the surgical and nonsurgical sides were also discussed.

Methods A retrospective medical chart review of immediate and severe (House–Brackman [HB] grade V and VI) traumatic facial palsy was conducted. Twenty-five ears from the surgical group and eight ears from the conservative treatment group were enrolled. Among the patients, three with immediate and severe bilateral facial palsy underwent unilateral surgery.

Results The average HB grade after 1-year follow-up was 1.7 in the surgical group and 1.5 in the nonsurgical group. Four patients who have definite facial canal disruption in the imaging study have recovered to HB grades I–III without surgical intervention. In patients with bilateral facial palsy, the nonsurgical side showed the same or better facial functions than the surgical side.

Conclusions Compared with nonsurgical conservative treatment, facial nerve decompression surgery did not show superior outcomes in immediate HB grade V–VI traumatic facial palsy. The clinical advantage of facial nerve decompression is questionable and should be re-evaluated in a prospectively designed study.

Keywords Bilateral facial palsy · Facial nerve decompression · House–Brackman grade

Introduction

Traumatic facial nerve palsy accounts for approximately 3% of all aetiologies of facial palsy [1]. It is associated with temporal bone fracture; the reported incidence varies from 7% to 68% [2, 3]. The most common injury site also varies across studies. Darrouzet et al. reported that 66.2% of patients with traumatic facial nerve palsy had a geniculate ganglion lesion [4]. Contrarily, Yetiser et al. reported that the mastoid segment is the most common affected area in 31.6% of the patients, followed by the geniculate ganglion at 15.8% [3]. Facial nerve decompression is a generally accepted treatment for traumatic facial nerve palsy. Theoretically, the mechanism of action involves relieving the pressure inside the nerve canal that is harmful to the regeneration of nerve function.

However, there is lack of clinical evidence indicating that facial nerve decompression surgery shows superior outcomes compared with those of medication or conservative care. This may be because ethical issues can arise for enrolling patients in the nonsurgical group. Furthermore, the obvious disruption of the facial nerve on computed tomography (CT) images might result in the reluctance for conservative care. In addition, the indication of surgery varies between institutions. Representatively, the cutoff value of the electroneuronography (ENoG) result varies from 90% to 95% of the degeneration ratio [5, 6]. In the same vein, the surgical indication applying House–Brackmann (HB) grade also varies from grade IV to VI [7, 8]. Furthermore, the CT imaging evidence of facial canal disruption is not consistently included in the indications of surgical intervention. However, acute and complete facial palsy is considered

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an indication of surgical treatment in most studies [8–10]. Delayed facial palsy (up to 94% complete recovery) and incomplete palsy (up to 100% complete recovery) have been shown to achieve satisfactory outcomes without surgical intervention [4, 11, 12].

Therefore, we reviewed patients with traumatic facial palsy due to temporal bone fracture and compared the results of the surgical and nonsurgical groups. In addition, the comparative outcomes of the surgical and nonsurgical sides in patients who underwent unilateral facial nerve decompression for bilateral acute severe palsy have been discussed to support the results of this study.

Methods

Patient enrolment

A total of 59 patients diagnosed with traumatic facial palsy with a temporal bone fracture were retrospectively searched in the author's affiliated hospital database between November 1, 2005 and November 1, 2021. Patient selection was conducted considering indication for facial nerve decompression. Twenty-three patients were excluded because of delayed or not severe facial palsy. HB grading system was used to evaluate the facial function. HB grades V–VI was defined as severe palsy. Four patients were excluded, because they did not have an initial facial function grade in their medical chart, two were excluded because of loss of follow-up after surgery, one was excluded, because the interval between surgery and injury was more than 3 months. Finally, 33 ears from 29 patients (4 patients were bilateral facial palsies, 3 of them conducted unilateral surgery) who met the indication for facial nerve decompression were enrolled. Among them, one side each of bilateral facial palsies were, respectively, included in the surgical ($N=25$) and nonsurgical ($N=8$) groups. This study was approved by the Severance hospital (Seoul, Korea) institutional review board (project number 4-2022-0479) and was performed in accordance with the Declaration of Helsinki.

Treatment protocols

Because of the retrospective nature of the study, the facial ENoG and electromyography were heterogeneously performed. The facial function evaluation was performed on the day of consultation. Indications for surgery were as follows: (1) immediate palsy (2) severe (HB grade V or VI) palsy, or ENoG degeneration ratio > 95%. The mean interval from injury to facial nerve decompression was 32.4 days (standard deviation 19.8, range from 8 to 77 days) after injury. There was no case of mastoid segment disruption, the decompression was routinely performed from the first genu to the second genu. The transmastoid approach was commonly used for facial nerve decompression in 21 cases, including four with a combined middle cranial fossa approach and one with a translabyrinthine approach. Endoscopic facial nerve decompression was performed in four cases.

The reasons for the eight nonsurgical cases were delayed schedule of more than 3 months (four patients), refusal for surgical intervention (two patients, including one patient with bilateral palsy), and recovery before subsequent surgery (two patients with bilateral palsies). High-dose steroid therapy (Prednisolone 1 mg/kg for 5 days followed by tapering dose) was routinely prescribed after identification of facial palsy in all cases except four patients whose facial palsy was identified later than 3 months after injury (all in the nonsurgical group).

Statistical analysis

Mann–Whitney test was used to compare the values from the two groups. Two-tailed Fisher's exact test was used to compare the proportions from the two groups. Statistical analyses were conducted using SPSS 25.0 (IBM, Armonk, NY, USA) and visualized using PRISM 8.0 (GraphPad Software, San Diego, CA, USA). A p value < 0.05 was considered statistically significant.

Result

Results of facial nerve function according to treatment

The demographic data of the two groups were not significantly different in terms of age, sex, side, bilateral palsy, and initial HB grade (Table 1). The proportion of complete palsy (HB grade VI) was also similar, 17 (68%) in the surgical group and 6 (75%) in the nonsurgical group. ($p=1.000$) The type of temporal bone fracture, otic capsule status, and definite facial canal disruption did not show a difference between the two groups. During the surgery, the most common injured location was the tympanic segment (44%) which was intraoperatively abnormal in 11 patients, followed by the unidentified cases (28%), the first genu (24%), and second genu (4%).

The facial function according to the time interval from the injury also did not show statistically significant difference between groups (Fig. 1). After 1-year follow-up, the average HB grades were 1.7 and 1.5 in the surgical and nonsurgical groups, respectively ($p=0.746$ by Mann–Whitney test). The proportion of HB grade I and II after 1-year follow-up was 85.0% and 87.5% in the surgical and nonsurgical groups, respectively ($p=1.000$). Interestingly, facial function

Table 1 Demographic data of the surgical and nonsurgical groups

	Surgical group	Nonsurgical group	*p* value
Median age (IQR), years	36 (22–49.5)	49.5 (36.25–55.75)	0.120
Male:female	21:4	8:0	0.550
Right:left	11:14	5:3	0.438
Bilateral palsy (%)	5 (20)	3 (37.5)	0.366
Median initial HBG (IQR)	6 (5.25–6)	6 (5.25–6)	0.789
Median final HBG (IQR)	1 (1–2)	1 (1–2)	0.746
Initial ENoG performed (%)	17 (68)	4 (50)	0.420
Initial ENoG > 95% (%)[a]	7 (53.8)	1 (50)	1.000
Fracture type (%)			0.205
Longitudinal	19 (76)	4 (50)	
Transverse	6 (24)	4 (50)	
Otic capsule (%)			0.574
Disrupted	3 (12)	2 (25)	
Spared	22 (88)	6 (75)	
Facial canal in TBCT (%)			0.420
Disrupted	8 (32)	4 (50)	
Spared	17 (68)	4 (50)	
Total number	25	8	N/A

IQR interquartile range, *HBG* House–Brackmann grade, *ENoG* electroneuronography, *TBCT* temporal bone computerized tomography, *N/A* not applicable

[a]Bilateral palsy data was excluded

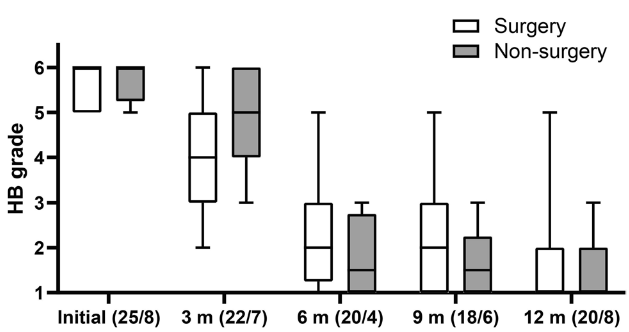

Fig. 1 Box and whiskers plot of facial function recovery according to the follow-up period. The box indicates the median (horizontal line in the box) and interquartile range, and the whiskers indicates the range. There were no statistically significant differences between the two groups. The white boxes indicate the surgical group, and the grey boxes indicate the nonsurgical group. The numbers in the parentheses represent the number of analysed cases in the surgical (left) and nonsurgical (right) groups. *HB grade* House–Brackmann grade, *m* follow-up months

recovery tended to reach a plateau 6 months after injury in both groups.

In the nonsurgical group, four patients (HB grade VI in all) showed definite facial canal disruption in the temporal bone CT (Fig. 2). Although they met the surgical intervention criteria, their facial function recovered to HB grades I–III at 6 months after injury without facial nerve decompression. Facial ENoG was conducted on two patients among the unilateral facial palsy patients, their results were 95.0% (HB grade was VI) and 94.44% (HB grade was V). They were recovered to HB grades I and II, respectively.

Results for surgery and non-surgery sides in bilateral traumatic facial palsy

Four patients showed immediate bilateral facial palsy after head trauma. Among them, three patients underwent unilateral facial nerve decompression surgery (Table 2). Patient 1 agreed to unilateral surgery and refused bilateral surgery. Patients 2 and 3 were scheduled to undergo subsequent surgery; however, the second surgery was cancelled, because the unoperated side spontaneously recovered after the first surgery.

The results were similar between the surgical and nonsurgical sides. Regardless of treatment, all facial palsies recovered better than or similar to HB grade II. Patient 1 showed better initial HB grade on the nonsurgical side; however, the initial electromyography and ENoG results indicated complete palsy and worse result on the nonsurgical side (surgical vs. nonsurgical side: HB grade VI and 0.1 mV vs. HB grade V and no response). Interestingly, the ENoG results after 4.5 years follow-up showed much better outcomes on the nonsurgical side (surgical vs. nonsurgical side: HB grade II and 1.4 mV vs. HB grade I and 4.2 mV).

Discussion

The facial function result of surgical intervention was not better than that of the nonsurgical group. Of the total, 85% and 87.5% of the patients showed improvement in facial function to HB grade I or II in the surgical (17 of 20) and nonsurgical groups (7 of 8), respectively. Even after appropriate timing of surgical intervention, one patient did not show improvement of better than HB grade V. On the contrary, all eight patients who met the surgical criteria have recovered better than HB grade III without surgery. In cases of bilateral traumatic facial palsy, the results were similar on both sides regardless of the treatment. Rather, the nonsurgical side showed better functional outcome than the surgical side in two patients. Taken together, the clinical advantage of facial nerve decompression over conservative treatment cannot be confirmed.

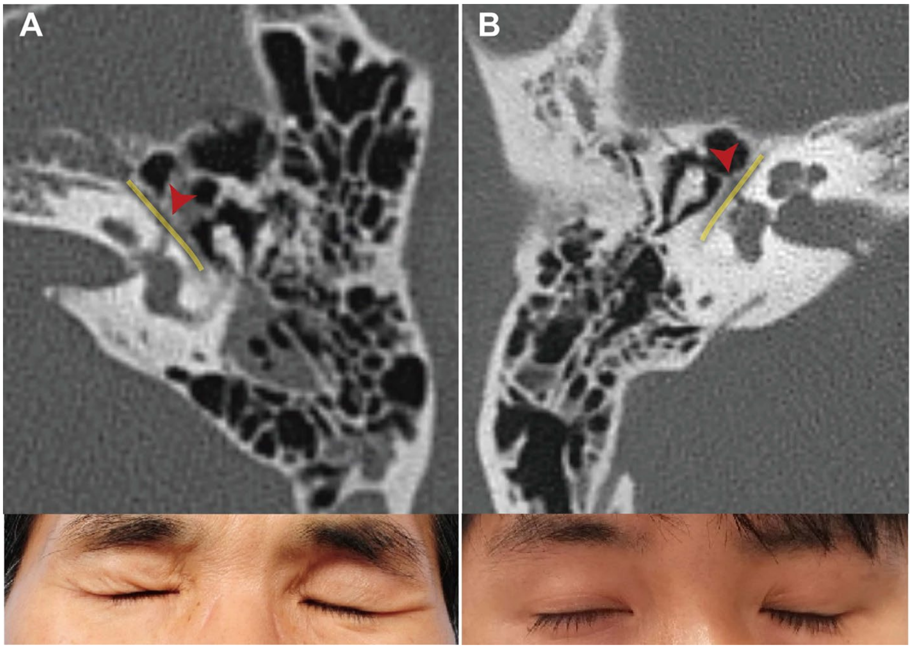

Fig. 2 Two representative cases in nonsurgical groups with definite facial canal disruption. Upper images are facial nerve tympanic segment in temporal bone computerized tomography. Lower images are the eye closure function of each patient 1 year after injury. **A** The fracture line crossed the anterior tympanic segment of the left facial nerve. One year after without surgery, facial function recovered to House–Brackmann grade III, and maximal eye closure was possible. **B** The fracture line crossed the anterior tympanic segment of the right facial nerve. One year after without surgery, facial function recovered to House–Brackmann grade II, and minimal eye closure was possible. Yellow lines indicate the facial nerve tympanic segment. Red arrowheads indicate fracture lines disrupting facial canal

Table 2 Clinical characteristics of patients with bilateral traumatic facial palsy

	Patient 1		Patient 2		Patient 3	
Age, years	9		46		48	
Sex	Male		Male		Male	
Initial ENoG interval, days	67		31		N/D	
F/u ENoG interval, days	1607		109		N/D	
Surgery interval, days	75		31		19	
	Surgery	Observation	Surgery	Observation	Surgery	Observation
Initial HB grade	VI	V	VI	VI	VI	VI
1 year HB grade	II	I	II	I	I	I
Initial ENoG (amp), mV	0.1	0	0.4	0.6	N/D	N/D
F/u ENoG (amp), mV	1.4	4.2	0.3	0.5	N/D	N/D
Type of fracture	Trans	Trans	Trans	Trans	Long	Long
Otic capsule	Spared	Spared	Spared	Spared	Spared	Spared
Facial canal	Disrupt	Intact	Disrupt	Intact	Disrupt	Disrupt

ENoG electroneuronography, *f/u* follow-up, *amp* amplitude, *Long* longitudinal, *Trans* transverse, *N/D* not done

This is not the first report that is sceptical of facial nerve decompression after traumatic facial nerve palsy. Recently, growing evidence indicates that facial nerve decompression might have little or no advantages in terms of functional recovery. In 2018, Thakar et al. reported the result of nonsurgical treatment of traumatic complete facial palsy [13]. They reported excellent outcomes with 96% (27 from 28) of the patients demonstrating initial HB grade VI recovery to HB grade I or II without surgery. Similarly, Yadav et al. also reported that nonsurgical treatment showed better outcomes than surgical treatment [14]. In their study, 90% (9 from 10) of the conservative care group recovered to HB grades I–III, and 85% (6 from 7) of the surgical group recovered to HB grades I–III. One patient after surgery showed HB grade V after the follow-up. Finally, a systematic review by Nash et al. in 2010 suggested the ambiguity of the clinical advantages of facial nerve decompression in immediate complete facial palsy after head trauma [15]. Although the literature on the treatment of traumatic facial nerve paralysis is heterogeneous with respect to evaluation methods, surgical approaches, and surgical indications, the authors suggested that nonsurgical treatment (118 patients) showed better results than surgical treatment (317 patients). The complete recovery (HB grade I) rate was 57% after observation and 21% after surgery. The rate of no recovery (HB grade VI) was 1.7% after observation and 10% after surgery. The results of our study support the findings of previous studies which suggested that facial nerve decompression surgery has no benefit or worse outcome compared with conservative care.

Traditionally, immediate and complete facial palsy after trauma is an indication for facial nerve decompression, because the prognosis is poor compared with that of delayed or incomplete palsy [4, 6, 11, 16–18]. However, the clinical evidence regarding facial nerve decompression is weak, because reports on the natural course of traumatic facial palsy are lacking. The first prospective research regarding the natural course of traumatic facial palsy is the abovementioned study by Thakar et al. [13]. Many studies reporting the outcomes of facial nerve decompression did not include a control group, focusing on the surgical approaches, timing of intervention, and range of nerve decompression [7, 9, 10, 19–24]. Interestingly, previous studies consistently reported that early intervention results in better prognosis [7, 19]. However, without a control group and prospective design, considerable selection bias can occur. It must be considered that candidates for surgery would be selected from among the patients who did not show improvement until a specific period. If that specific period is prolonged, the surgical outcome would be poor regardless of the treatment itself, because the proportion of patients with poor prognosis (the prognosis is unknown at the time) is increased among the surgical candidates who do not show recovery at the specific time.

Interestingly, the labyrinthine segment and the mastoid segment were intact for all cases. It may because most of the fracture line tended to cross middle ear. The definite facial canal disruption was unexpectedly rare in the surgical group (32%), rather, the nonsurgical group (50%) has a higher proportion of facial canal disruption in the CT. The good result of these patients in the nonsurgical group supports the sceptical view of facial nerve decompression. Furthermore, surgical intervention may not be required unless the facial nerve is severed along the fracture line. In this case, facial nerve decompression followed by neurorrhaphy should be considered.

This study had some limitations. The timing of facial nerve decompression was not controlled in this retrospective study. However, although surgical intervention is recommended as early as possible, as previously reported, facial nerve decompression is still effective within 3 months after injury [19, 22]. Because surgeons tend to intervene in more severe cases, comparison of surgical and nonsurgical outcomes requires consideration of selection bias. In addition, this study included a small number of patients, especially in the nonsurgical group. Moreover, most previous studies adopted an HB grading system that is dependent on the evaluator's judgement. Therefore, it is inconclusive whether facial nerve decompression should be continued to be performed in the same manner. However, it is worth discussing that surgery does not show better outcomes than nonsurgical conservative treatment even in patients with bilateral palsy undergoing unilateral surgery. A prospective case–control study in a large cohort is required for evaluating the clinical evidence of facial nerve decompression. Furthermore, the possible unexpected surgical trauma to the facial nerve needs to be investigated when considering the consistently reported tendency of worse outcomes in the facial nerve decompression group compared with those in the conservative care group.

In conclusion, compared with conservative treatment, facial nerve decompression surgery did not show superior outcomes in immediate HB grade V–VI traumatic facial palsy. In three patients with bilateral traumatic facial palsy who underwent unilateral surgery, the function of the nonsurgical side was same or better than that of the surgical side after 1-year follow-up. Therefore, the clinical advantage of facial nerve decompression in traumatic facial palsy was not readily apparent in this study.

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Declarations

Conflict of interest All authors declare that there is no potential conflict of interest.

Ethics approval and consent to participate This study was approved by the Severance hospital (Seoul, Korea) institutional review board (project number 4-2022-0479) and was performed in accordance with the Declaration of Helsinki.

Consent for publication Not applicable.

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